



Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) Publication number: **0 471 981 B1**

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication of patent specification :
08.03.95 Bulletin 95/10

(51) Int. Cl.⁸ : **G01N 35/04**

(21) Application number : **91111836.2**

(22) Date of filing : **16.07.91**

(54) Device for transporting containers filled with a liquid.

(30) Priority : **20.07.90 DE 4023184**

(43) Date of publication of application :
26.02.92 Bulletin 92/09

(45) Publication of the grant of the patent :
08.03.95 Bulletin 95/10

(84) Designated Contracting States :
DE FR GB

(56) References cited :
EP-A- 0 223 002
DE-A- 2 632 035
US-A- 3 504 376
US-A- 4 387 991

(73) Proprietor : **EASTMAN KODAK COMPANY**
343 State Street
Rochester, New York 14650-2201 (US)
Proprietor : **KODAK AKTIENGESELLSCHAFT**
D-70323 Stuttgart (DE)

(72) Inventor : **Litsche, Mario**
c/o Kodak Aktiengesellschaft,
Postfach 60 03 45
W-7000 Stuttgart-Wangen 60 (DE)

(74) Representative : **Blickle, K. Werner, Dipl.-Ing.**
et al
KODAK AKTIENGESELLSCHAFT
Patentabteilung
D-70323 Stuttgart (DE)

EP 0 471 981 B1

Note : Within nine months from the publication of the mention of the grant of the European patent, any person may give notice to the European Patent Office of opposition to the European patent granted. Notice of opposition shall be filed in a written reasoned statement. It shall not be deemed to have been filed until the opposition fee has been paid (Art. 99(1) European patent convention).

Description

The invention relates to a device for transporting in an analyzer containers (4) filled with a liquid and arranged in a tray (5), in particular test tubes filled with a body fluid, from an input station (1) to a processing station (15, 16) and back.

Various analyzers are known which are provided with automatic transport means and can process a number of samples or body fluids to be examined.

From DE-A-26 32 035 an apparatus is known for automatically advancing samples to be examined and contained in test tubes to a processing station of an analyzer and back. A plurality of test tubes are carried by an elongate tray with the trays themselves being held in a magazine. Each tray is associated with a locking means which is selectively controllable and can be released in a tray removal station. A first advancing means moves the magazine from an input station to said tray removal station. Removal of the trays is effected by a second advancing means arranged normal to said first means and advancing the trays filled with test tubes to the processing station. The two advancing means are provided with conveyor belts driven by reversible stepping motors that can be selectively advanced. The first advancing means comprises two toothed conveyor belts and a sliding path therebetween, the teeth of the belts engaging with corresponding teeth arranged at the lower side of the tray magazine. The second advancing means is provided with a conveyor belt having a drive pin engaging a slot at the lower side of the tray.

Another apparatus is known from DE-A-32 42 459 using a sample distributor having a number of carriers for test tubes arranged on a round rotatable plate. Insertion of the carriers equipped with test tubes is effected through an input and removal opening at the front side of the apparatus with the carrier being put on plugs arranged on the plate's rim. Subsequently, the carriers are advanced together with the test tubes to a processing/aspirator station, which is effected by rotating the plate by means of a microprocessor controlled drive mechanism.

It is the object of the present invention to provide an apparatus of the generic type which is of uncomplicated design and permits simple loading and easy access to containers arranged in the apparatus. The processing rate is to be increased considerably in order to meet the requirements of a fast and reliable diagnosis.

The above object is attained in that for receiving the trays the input station consists of a plurality of tray tracks arranged side by side and whose central axes intersect in a point which also forms the fulcrum of a pivotally arranged transport path that can be aligned with any of the tray tracks.

Further features and advantages will be described in detail with reference to an embodiment of the invention shown in the drawing and claimed in the subclaims.

- | | |
|------------|--|
| Fig. 1a | shows a top view of the device according to the invention including an input station and a transport path, |
| 35 Fig. 1b | the control unit of the device |
| Fig. 2 | represents a top view (partly in cross-section) of the input station of the device according to Fig. 1, |
| Fig. 3 | shows a cross-section along the line B-B in Fig. 2 of the input station of the device according to Fig. 1 including a tray track, |
| 40 Fig. 4 | shows a cross-section along the line C1-C1 in Fig. 1 of the transport path of the device according to Fig. 1, |
| Fig. 5 | shows a cross-section along the line C2-C2 in Fig. 1 of the transport path of the device according to Fig. 1 including a passage |
| 45 Fig. 6 | shows a cross-section along the line D-D in Figs. 1 and 7 of the transport path of the device according to Fig. 1 including the tray movement member and the drive elements, and |
| Fig. 7 | shows a cross-section along the line E-E in Fig. 6 of the transport path of the device according to Fig. 1 including the drive elements. |

An input station 1 shown in Fig. 1 is comprised of four tray tracks 3 arranged side by side on a support plate 2 for receiving trays 5 carrying test tubes 4. The central axes 6 of the tray tracks 3 intersect in a point 7. All tray tracks 3 are separated from one another by partitions 8 and countersunk in the support plate 2 by about twice the height of the widened base (83) of tray 5 (see Fig. 5). The partitions 8 are recessed from the outer border 9 of the input station 1 and extend as far as their arcuately arranged exits 10. The partitions 8 are wedge-shaped with their widened and rounded end portions facing the outer border 9. The tray tracks 3 show a length and width which are somewhat larger than those of base 83 of each tray 5.

Between input station 1 and intersecting point 7 a transport path 12 is arranged which is formed as an elongated housing 11 and can be pivoted about a fulcrum 84 the center of which lies in point 7. The transport path can be pivoted to any of the tray tracks 3 and aligned with a zero position 13 arranged adjacent to the tray tracks 3. The transport path 12 extends as far as the arcuately arranged exits 10 of input station 1. The

center of the arc also lies in intersecting point 7.

Lateral to the transport path 12, a tray movement member 14 is longitudinally slideable and is used for transporting tray 5 from the input station 1 to a processing station 15 and back. The tray movement member 14 reaches through an elongate opening 81 provided in housing 11.

5 In a processing station 15 an aspirator 20 is provided having a proboscis 21 for removing body fluid from the test tube 4 as well as a detector means 22 for scanning a test tube 4. Processing station 15 is arranged about halfway down the transport path 12 pivoted to its zero position, with the transport path 12 being approximately twice as long as a tray 5. This design permits tray 5 to move to processing station 15 both with its first and last test tube 4 without its trailing end extending into the input station 1.

10 A second processing station 16 for opening and closing the test tubes 4 is arranged along transport path 12, that is to say in an end position 17 opposed to the zero position 13 which is also halfway down between input station 1 and intersecting point 7. Furthermore, a bar code scanner (18) is provided between processing station 15 or 16 and input station 1 reading the patient's data printed on the test tubes 4.

15 Each exit 10 of the tray tracks 3 is provided with a retaining means (19) which is disengageable when the transport path 12 is aligned with a tray track 3.

While the input station 1 with its tray tracks 3 is accessible to an operator, the transport path 12 and the processing stations 15 and 16 are covered by a wall 57 within the analyzer. Partitions 8 which are somewhat higher than the tray 5 prevent access through passage 58 (see Fig. 5).

20 Figs. 2 and 3 show the retaining means 19 arranged below the support plate 2 of input station 1. Each retaining means 19 is designed as a rocker which is vertically pivotable about an axis of rotation 23. A first rocker arm 24 of retaining means 19 partly extends into tray track 3 and its end portion in the area of an exit 10 is provided with a blocking element 25 for a tray 5. The second rocker arm 24', on the one hand, consists of a blade 26 whose end portion extends into the light path of an optical sensor 27 designed as a light barrier and, on the other, of a finger 28. A leaf spring 29 mounted to the support plate engages said first rocker arm 24 and forces the blocking element 25 into the area of exit 10 of a tray track 3.

25 Furthermore, beneath the outer end portions of partitions 8 the input station 1 comprises a circularly extending rib 30 having slots 31 associated with the tray tracks 3. Zero position 13 is characterized by two slots. A sensor 32 designed as a light barrier and mounted on an outrigger 33 of transport path 12 is used for scanning slots 31 so as to align transport path 12 with the tray tracks 3 and the zero position.

30 In the area of the exits 10 and beneath the transport path 12 a support plate 34 is provided having an arcuate rack 35 at its end portion facing the transport path 12. A pinion 36 supported by housing portion 51 engages with said rack 35, with said pinion 36 being connected to a drive mechanism by means of a toothed belt 37. A support bracket 38 which is mounted to housing portion 51 is provided with two supports 39 that slide on the support plate 34 when the housing portion 51 and thus the transport path 12 are pivoted.

35 Fig. 3 shows the retaining means 19 in its first end position to which it is urged by leaf spring 29, blocking element 25 of the first rocker arm 24 extending into exit 10 of an empty tray track 3. In this case, the blade 26 arranged at the other end of the rocker is positioned below the sensor 27 thus uncovering same. When a tray 5 equipped with test tubes 4 is inserted in the tray track 3, the retaining means 19 pivots about axis of rotation 23 to a second position shown in dotted lines in which, on the one hand, the blocking element 25 still extends into the tray track 3 and, on the other, blade 26 covers the sensor 27.

40 On the outrigger 33 connected to housing 11 an electromagnet 40 is mounted beneath the retaining means 19 which energized moves a plunger 41 along the central axis 6 and thus actuates the finger 28 of retaining means 19. Subsequently, retaining means 19 pivots to its third position and exit 10 of the tray track 3 is disengaged and sensor 27 is uncovered. After de-energizing the electromagnet 40, plunger 41 is returned to its home position shown in the drawing by means of a helical spring 42.

45 Furthermore, Fig. 3 shows the support plate 34 and the support bracket 38 in connection with one of the two supports 39 having a screw 43 by means of which the housing portion 51 and thus the transport path 12 can be adjusted in height in the region of the exits 10 of input station 1. Support bracket 38 is S-shaped and connected to the bottom portion 44 of housing 11 and, in addition, serves as a bearing for shaft 45 on which pinion 36 and the drive roller 46 for the pivot drive of transport path 12 are arranged. On its outer end, the bottom portion 44 carries the outrigger 33 which in turn carries a shaft 47 with an idler 48 in addition to the electromagnet 40 and sensor 32, said idler 48 - together with a toothed belt 49 - belonging to a drive mechanism for the tray movement member 14.

50 A guide 50 for the trays 5 which is associated with each exit 10 of a tray track 3 and consists of guide webs is provided at transport path 12. Also the electromagnet 40 and the idler 48 are accommodated in the housing 11 defining the transport path 12 and are thus protected from fouling.

As shown in Fig. 4, the transport path 12 consists of a rectangularly shaped tubular housing 11 which is substantially closed all-around and is formed of a housing portion 51 of U-shaped cross-section and a bottom

portion 44 of L-shaped cross section that are connected so as to define an elongate opening 81.

On both sides of the transport path 12 T-shaped guide posts 52 are arranged between which the widened base 83 of tray 5 is guided. The tray movement member 14 extending into the interior of housing 11 through the elongate opening 81 and connected to the toothed belt 49 by means of a clamping element 53 is mounted to one side of housing 11. Also a bolt 54 and an angular member 55 are connected to clamping element 53. Bolt 54 and angular member 55 rest on a spherical support surface 85 on the inner side of housing portion 51 and on the exterior side thereof, respectively. At its lower end portion, angular member 55 is also provided with a spherical elevation 86 sliding in a prism-shaped guide means 87 of housing portion 51. At the top end of the tray movement member 14 a hook 56 is mounted which above the guide posts 52 extends laterally and horizontally beyond the center of transport path 12 and for advancing tray 5 engages an eyelet 80 provided on the front side of the tray.

Fig. 5 shows the transport path 12 in the region of the exit 10 of a tray track 3. The two laterally arranged guides 50 can be seen on the transport path 12. Behind thereof are shown an interior view of a wall 57 and the partitions 8 of the input station 1 which define a passage 58 through which only trays 5 having a predetermined height and width can reach the transport path. The lower end of the partitions 8 are provided with horizontally extending guide fins 8' which above the widened base 83 of an inserted tray 5 and laterally extend into the tray track 3.

Below the transport path 12 and within the housing 11, respectively, the arrangements of the idler 48 of the drive mechanism of the tray movement member 14 and of the electromagnet 40 can be seen.

Fig. 6 shows the transport path 12 with a tray 5 positioned thereon. Along transport path 12 guide posts 52 which as to their cross-section correspond to said guide fins 8' are arranged in spaced relation to each other so as to define reliable guidance for tray 5 and permit obstacles that may lie in the transport path 12 to be cleared sideways out of the way by tray 5. This prevents the tray from getting stuck.

Beneath the bottom portion 44 of housing 11 a stepping motor 61 is mounted which by means of a drive gear 62, a toothed belt 63 and a guide roller 65 mounted on shaft 64 drives a drive gear 66 and, thus, by means of toothed belt 49 and the idler 48, the tray movement member 14 (see Fig. 3). On shaft 88 driven by means of the toothed belt 49 an encoder wheel 67 is mounted whose rotary movement is detected by a sensor 68 designed as a light barrier.

Another stepping motor 69 is mounted adjacent stepping motor 61 on the bottom portion 44, said motor 69 - by means of drive gear 70 and the toothed belt 37 - driving pinion 36 for pivoting transport path 12. When transport path 12/housing 11 is pivoted, it rotates about journal 59 arranged in fulcrum 84 in a bearing block 71.

Fig. 7 shows the arrangement of the stepping motors 61 and 69 with the drive gears 62 and 70 as well as the toothed belts 37, 49 and 63. The encoder wheel 67 mounted on shaft 88 has opaque and transparent sectors 72 which during rotation of the encoder wheel 67 are scanned by the sensor 68. The number of pulses thus generated is in this case proportional to the movement of the tray movement member 14 along transport path 12.

Furthermore, the structure of bearing block 71 is represented which is mounted to a chassis 74 by means of two screws 73. Also shown is the position of journal 59 for the housing 11.

The device operates as follows:

First, one or several trays 5 equipped with test tubes 4 are placed in the four tray tracks 3 of input station 1. Each test tube filled with a patient's body fluid is provided with specific patient's data and processing instructions which are prepared at the beginning of an examination and transferred to a memory 75 of an electronic control unit 76 of the analyzer (see Figs. 1a and 1b). Upon insertion of trays 5, the number of the tray track 3 and the position of the test tube 4 in tray 5 are added to the aforementioned data by means of the keyboard 77 connected to the control unit 76.

If now by means of the keyboard 77 processing of the body fluids is started, it is effected according to a program stored in the control unit 76 in cooperation with a microprocessor 78. This procedure can individually be preselected by means of the keyboard 77, which means that loading the tray track 3 with trays 5 and equipping the trays 5 with test tubes 4 can be performed and altered individually. (See Fig. 1b).

In this way, an analyzer is provided which can be flexibly handled and can process a relatively large amount of samples of body fluids quickly and in any order whatever according to the respective requirements.

After starting the program it is detected whether a tray 5 is present in the selected tray track 3 of the input station. This is done by inquiring the sensor 27 beneath the retaining means 19 and shown in Figs. 2 and 3 which when a tray 5 is present is covered by the blade 26 of retaining means 19. If a tray 5 is present in a tray track 3, the transport path 12 is pivoted about journal 59 in the direction of the tray track 3 selected. Pivoting is effected by the stepping motor 69, the drive gear 70, the toothed belt 37 and the pinion 36 meshing with rack 35, the stepping motor 69 being controlled by the microprocessor 78. The position of the transport path

12 is detected on the one hand, by the stepping pulses of the stepping motor 69 and, on the other, by sensing the slots 31 associated with the tray tracks 3 by means of the sensor 32 mounted on the outrigger 33. When the transport path 12 has reached the tray track 3 selected, it pivots in response to its pivoting direction a certain amount beyond said tray track or back in the opposite direction. Said amount is chosen such that the hook 56 of the tray movement member 14 guided at the side of housing 11 can move past the eyelet 80 of tray 5 when said member 14 moves along transport path 12. When during movement of the tray movement member 14 from point 7 to tray track 3 hook 56 is positioned in the area of the central axis of eyelet 80, transport path 12 pivots back to the extent that hook 56 engages the eyelet 80 and transport path 12 is aligned with tray track 3.

5 10 When the electromagnet 40 is controlled by the microprocessor 78 such that plunger 41 via finger 28 pivots the retaining means 19 with its blocking element 25 downwards and the blade 26 of retaining means 19 uncovers the sensor 27. Thus, exit 10 of tray track 3 is open for moving tray 5 onto transport path 12 by means of the tray movement member 14.

15 Operation of the tray movement member 14 is effected via stepping motor 61, drive gear 62, toothed belt 63, guide roller 65, drive gear 66, toothed belt 49 and the idler 48, with the tray movement member 14 being connected to toothed belt 49. The stepping motor 61 is controlled by the microprocessor 78. An encoder wheel 67 mounted to shaft 88 and a sensor 68 are provided to determine the position of tray movement member 14 and thus tray 5 along the transport path 12. Upon rotation of shaft 88, the opaque and transparent sectors 72 of encoder wheel 67 generate pulses in sensor 68, the number of pulses being proportional to the path of movement of tray movement member 14 (see Fig. 6).

20 As soon as tray movement member 14 has pulled tray 5 with the test tubes 4 completely onto transport path 12, it is pivoted to the zero position 13 located adjacent to the tray tracks 3 and characterized by two slots 31. During this procedure the electromagnet 40 is de-energized and its plunger 41 returned to its home position by means of the helical spring 42. At the same time, retaining means 19 with the blocking element 25 is pivoted upwards back into the exit 10 of tray track 3 by means of leaf spring 29. Retaining means 19 thereby reaches its upper end position in which the blade 26 uncovers the sensor 27. It can now be detected whether a tray 5 is present in the tray track 3 or whether exit 10 of tray track 3 is empty. This is considered by the microprocessor in that it stops the program when a tray track 3 is occupied inadmissibly or even by two trays 5 at the same time and indicates this as an error on a display panel 79. Subsequently, tray 5 is moved to processing station 15 with the test tube predetermined in the program. In this station test tube 4 is first detected by detector means 22 and then body fluid is removed by means of the proboscis 21 of aspirator 20. Removal of the body fluids from the remaining test tubes 4 is effected in the same way. When all body fluids have been removed from the test tubes 4 of tray 5, transport path 12 pivots back to the initial tray track 3 and tray 5 is returned to the latter. Prior thereto, the retaining means 19 is again pivoted back by means of plunger 41 of electromagnet 40. Selection of further trays 5 from input station 1 and their transport to processing station 15 and back to the tray tracks 3 is performed in the same manner as described above.

30 35 40 45 Advantageously, control unit 76 offers blocking protection for the stepping motors 61 and 69 which, on the one hand, is realized by monitoring the rotary movement of the encoder wheel 67 by means of sensor 68 and, on the other, by comparing the predetermined and the actual number of steps of the stepping motors 61 and 69. The blocked stepping motors are de-energized and an error is indicated on display 79. Undesired blocking may occur when a tray 5 of inadmissible height is inserted into one of the tray tracks 3 which is then pulled against the upper limiting edge of the passage 58 of wall 57. Blocking also occurs due to jamming of the base 83 of an inadmissible tray 5 between guide post 52 and transport path 12.

45 Furthermore, it is advantageous to control the attractive force of plunger 41 by a first low current pulse with a subsequent high current pulse and to reduce the release speed by means of reverse current pulses in order to minimize noise.

50 The functional procedure is changed by an appropriate development of the device in that, on the one hand, a scanner 18 is provided between input station 1 and processing station 15 for the patient's data available in the form of a bar code and in that on the other, a second processing station 16 is provided in the end position 55 57 for opening and closing the test tubes 4. This means that tray 5 equipped with test tubes 4 reaches the detector means 22 and the aspirator 20 only via the opening/closing means 16 and the scanner 18. Manual opening of the test tubes 4 and entering the patient's data by means of the keyboard 77 prior to inserting the trays 5 into the tray tracks 3 is thus eliminated, which results in an easier and more reliable operation.

1. Device for transporting in an analyzer containers (4) filled with a liquid and arranged in a tray (5), in par-

- ticular test tubes filled with a body fluid, from an input station (1) to a processing station (15, 16) and back, characterized in that for receiving the trays (5) the input station (1) consists of a plurality of tray tracks (3) arranged side by side and whose central axes (6) intersect in a point (7) which also forms the fulcrum (84) of a pivotally arranged transport path (12) that can be aligned with any of the tray tracks (3).
- 5 2. Device according to claim 1, characterized in that the transport path (12) consists of a housing (11) which can be pivoted about fulcrum (84) and whose free end portion extends as far as the arcuately arranged exits (10) of tray tracks (3), and in that housing (11) is moved by a stepping motor (69) controlled by a microprocessor.
- 10 3. Device according to claims 1 and 2, characterized in that an arcuate rack (35) is provided which engages with a gear (36) arranged at the transport path (12) and connected to the stepping motor (69).
- 15 4. Device according to claims 1 and 2, characterized in that for aligning the transport path (12) each of the tray tracks (3) is associated with a slot (31) that can be scanned by a sensor (32).
- 15 5. Device according to claims 1 and 2, characterized in that the transport path (12) can be pivoted to a zero position (13) adjacent to the tray tracks (3).
- 20 6. Device according to claim 5, characterized in that for aligning the transport path (12) in the zero position (13) more than one sensor-scannable slot (31) is provided.
- 25 7. Device according to claim 5, characterized in that in the zero position (13) of transport path (12) one of the containers (4) is positioned below an aspirator (20) for the liquid and at the same time in the area of a detector means (22) for scanning the container.
- 25 8. Device according to claim 1, characterized in that in the area of each tray track (3) a retaining means (19) for an inserted tray (5) is provided which means is engageable when the transport path (12) is aligned with the respective tray track (3).
- 30 9. Device according to claim 8, characterized in that the retaining means (19) is formed as a rocker whose first rocker arm (24) serves as a blocking element (25) for a tray (5) present in the tray track (3) and whose second arm (24') is designed as a blade (26) which in a first position when the tray track (3) is empty uncovers a photosensor (27) and in a second position when a tray (5) is present in tray track (3) covers the sensor (27).
- 35 10. Device according to claim 9, characterized in that for moving the retaining means (19) to a third position in which the transport path (12) is disengaged and the sensor (27) is uncovered the second rocker arm (24') is provided with a finger (28) which can be operated by means of a plunger (41) of an electromagnet (40).
- 40 11. Device according to claims 9 and 10, characterized in that the electromagnet (40) is controlled by means of a microprocessor (78) in response to the signals of the sensor (27).
- 45 12. Device according to claims 10 and 11, characterized in that the attractive force and the release speed of the electromagnet (40) are controlled.
- 45 13. Device according to claim 12, characterized in that the attractive force is controlled by means of two current steps and the release speed by means of reverse-current pulses.
- 50 14. Device according to claims 1 and 2, characterized in that an outrigger (33) is arranged at the transport path (12) which holds the electromagnet (40) for the retaining means (19) and a sensor (32) associated with the slots (31) of the input station (1).
- 55 15. Device according to claims 1 and 2, characterized in that in the area of the input station (1) a circularly formed support plate (34) is provided on which supports (39) connected to the transport path (12) are slidingly supported.
- 55 16. Device according to claim 15, characterized in that two supports (39) are mounted which can be adjusted in height.

17. Device according to claims 1 and 2, characterized in that at the transport path (12) a tray movement member (14) is provided which can be coupled with tray (5) and moved by means of a microprocessor-controlled stepping motor (61).
- 5 18. Device according to claim 17, characterized in that the tray movement member (14) is slidingly guided at the transport path (12) and includes a hook (56) extending beyond the centerline of the transport path.
- 10 19. Device according to claim 18, characterized in that when a tray (5) is present in a tray track (3), hook (56) of tray movement member (14) engages an eyelet (80) formed on tray (5) as soon as the transport path (12) is pivoted.
- 15 20. Device according to claim 17, characterized in that the movement of the tray movement member (14) is controlled by means of a pulse generator (67, 68).
- 20 21. Device according to claim 20, characterized in that the pulse generator (67, 68) is controlled by a micro-processor.
- 25 22. Device according to claim 20, characterized in that the pulse generator consists of a rotatable encoder wheel (67) and a sensor (68).
- 30 23. Device according to claims 1 and 2, characterized in that the transport path (12) can be pivoted to an input station (1) which defines an end position (17) being opposed to the zero position (13) and in which an opening means (16) for the containers (4) is provided.
- 35 24. Device according to claims 1 thru 5, characterized in that a patient's data scanner (18) reading the data provided on the containers (4) is arranged in the zero position (13) or in the end position (17) between input station (1) and a processing station (15, 16).
- 40 25. Device according to claims 1 and 2, characterized in that the transport path (12) is comprised of a rectangularly shaped tubular housing (11) which is substantially closed all-around and has an elongate opening (81) in the area of a bottom portion (44), and in that the tray movement member (14) reaches through the elongate opening (81) and is connected to a toothed belt (49) driven by the stepping motor (61).
- 45 26. Device according to claims 1, 2 and 25, characterized in that the components forming the transport elements for the tray movement member (14), e.g. stepping motor (61), idler (48) and toothed belt (49), are arranged in the interior of housing (11).
- 50 27. Device according to claims 1, 2 and 25, characterized in that the transport path (12) is comprised of a elongated housing portion (51) of U-shaped cross-section and an elongated bottom portion (44) of L-shaped cross-section.
- 55 28. Device according to any of claims 1 thru 27, characterized in that the trays (5) are guided by T-shaped guide posts (52) arranged on the transport path (12).
29. Device according to claim 1, characterized in that the tray tracks (3) are separated from each other by partitions (8).
30. Device according to claim 29, characterized in that the partitions (8) are recessed from the tray tracks' outer border (9) by a predetermined amount and extend as far as the exits (10).
31. Device according to claims 29 and 30, characterized in that the partitions (8) are wedge-shaped, the wide end portions of the wedges facing said outer border (9).
32. Device according to any of claims 29 thru 31, characterized in that the partitions (8) are rounded at their outer ends.
33. Device according to any of claims 30 thru 32, characterized in that the partitions (8) are shorter than the trays (5) by a predetermined amount.
34. Device according to claims 1 and 29, characterized in that the input station (1) comprises a wall (57) and partitions (8) which in the area of the exits (10) of the tray tracks (3) define passages (58) which are adapt-

ed to shape and size of the trays (5).

35. Device according to claim 34, characterized in that the partitions (8) have guide fins (8') laterally extending into the tray tracks (3).
- 5 36. Device according to any of claims 1 thru 35, characterized in that the transport path (12) is at least twice as long as tray (5).
37. Device according to claim 1, characterized in that the tray tracks (3) are arranged on a support plate (2).
- 10 38. Device according to claim 37, characterized in that the tray tracks (3) are countersunk in the support plate (2) by an amount corresponding to at least twice the height of base (83) of tray (5).

Patentansprüche

15

1. Vorrichtung zum Transportieren von in einem Halter (5) angeordneten Behältern (4) mit einer Flüssigkeit, insbesondere von Reagenzgläsern mit einer Körperflüssigkeit, in einem Analysegerät aus einer Eingabestelle (1) zu einer Bearbeitungsstation (15, 16) und zurück, dadurch gekennzeichnet, daß zur Aufnahme der Halter (5) die Eingabestelle (1) aus mehreren strahlenförmig nebeneinander angeordneten Einstellplätzen (3) besteht, deren Längsmittelachsen (6) sich in einem Schnittpunkt (7) schneiden, in dem zugleich der Drehpunkt (84) einer schwenkbar angeordneten Transportbahn (12) liegt, die zu jedem der Einstellplätze fluchtend ausrichtbar ist.
2. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Transportbahn (12) aus einem um den Drehpunkt (84) schwenkbaren Gehäuse (11) besteht, dessen freies Ende sich bis zu den auf einem Kreisbogen liegenden Ausgängen (10) der Einstellplätze (3) erstreckt und daß das Gehäuse (11) von einem mikroprozessorgesteuerten Schrittmotor (69) antreibbar ist.
3. Vorrichtung nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß eine kreisbogenförmig ausgebildete Zahnstange (35) vorgesehen ist, in die ein an der Transportbahn (12) gelagertes und mit dem Schrittmotor (69) verbundenes Zahnrad (36) eingreift.
4. Vorrichtung nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß zum Zwecke des Ausrichtens der Transportbahn (12) zu jedem Einstellplatz (3) ein mittels eines Sensors (32) abtastbarer Schlitz (31) zugeordnet ist.
- 30 5. Vorrichtung nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß die Transportbahn (12) in eine benachbart zu den Einstellplätzen (3) liegende Nullstellung (13) verschwenkbar ist.
- 35 6. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß in der Nullstellung (13) mehr als ein sensor-abtastbarer Schlitz (31) zum Ausrichten der Transportbahn (12) vorgesehen ist.
7. Vorrichtung nach Anspruch 5, dadurch gekennzeichnet, daß in der Nullstellung (13) der Transportbahn (12) einer der Behälter (4) unterhalb einer Entnahmeverrichtung (20) für die Flüssigkeit und gleichzeitig im Bereich einer Detektiereinrichtung (22) zum Abtasten des Behälters angeordnet ist.
- 40 8. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß im Bereich jedes Einstellplatzes (3) eine Rückhaltesperre (19) für einen eingesetzten Halter (5) vorgesehen ist, die bei auf diesen Einstellplatz (3) ausgerichteter Transportbahn (12) freigebbar ist.
- 50 9. Vorrichtung nach Anspruch 8, dadurch gekennzeichnet, daß die Rückhaltesperre (19) als Wippe ausgebildet ist, deren erster Wippenarm (24) als Sperrglied (25) für einen in dem Einstellplatz (3) befindlichen Halter (5) dient und deren zweiter Wippenarm (24') als Schaltfahne (26) ausgeführt ist, die bei leerem Einstellplatz (3) in einer ersten Stellung den Lichtweg eines Sensors (27) freigibt und bei einem im Einstellplatz (3) befindlichen Halter (5) in einer zweiten Stellung den Sensor (27) abdeckt.
- 55 10. Vorrichtung nach Anspruch 9, dadurch gekennzeichnet, daß zur Bewegung der Rückhaltesperre (19) in eine dritte Stellung, in der die Transportbahn (12) und der Sensor (27) freigegeben sind, der zweite Wippenarm (24') einen Schaltarm (28) aufweist, der mittels eines Stößels (41) eines Elektromagneten (40)

betätigbar ist.

11. Vorrichtung nach den Ansprüchen 9 und 10, dadurch gekennzeichnet, daß der Elektromagnet (40) in Abhängigkeit von den Signalen des Sensors (27) mittels eines Mikroprozessors (78) steuerbar ist.
- 5 12. Vorrichtung nach den Ansprüchen 10 und 11, dadurch gekennzeichnet, daß die Anzugskraft und die Abfallgeschwindigkeit des Elektromagneten (40) steuerbar sind.
- 10 13. Vorrichtung nach Anspruch 12, dadurch gekennzeichnet, daß die Anzugskraft durch zwei Stromstufen und die Abfallgeschwindigkeit mittels Gegenstromimpulsen steuerbar sind.
14. Vorrichtung nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß ein Ausleger (33) an der Transportbahn (12) angeordnet ist, der den Elektromagneten (40) für die Rückhaltesperre (19) und einen den Schlitten (31) der Eingabestelle (1) zugeordneten Sensor (32) trägt.
- 15 15. Vorrichtung nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß im Bereich der Eingabestelle (1) eine kreisbogenförmig ausgebildete Lagerplatte (34) vorgesehen ist, auf der mit der Transportbahn (12) verbundene Lagerstützen (39) gleitend aufliegen.
16. Vorrichtung nach Anspruch 15, dadurch gekennzeichnet, daß zwei in der Höhe justierbare Lagerstützen (39) angebracht sind.
- 20 17. Vorrichtung nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß an der Transportbahn (12) ein mit dem Halter (5) kuppelbarer Mitnehmer (14) vorgesehen ist, der mittels eines mikroprozessorgesteuerten Schrittmotors (61) bewegbar ist.
- 25 18. Vorrichtung nach Anspruch 17, dadurch gekennzeichnet, daß dadurch gekennzeichnet, daß der Mitnehmer (14) gleitend an der Transportbahn (12) geführt ist und einen Mitnahmestift (56) aufweist, der über die Mitte der Transportbahn ragt.
- 30 19. Vorrichtung nach Anspruch 18, dadurch gekennzeichnet, daß bei in einem Einstellplatz (3) befindlichem Halter (5) beim Verschwenken der Transportbahn (12) der Mitnahmestift (56) des Mitnehmers (14) in eine am Halter (5) ausgebildete Öse (80) eingreift.
20. Vorrichtung nach Anspruch 17, dadurch gekennzeichnet, daß die Bewegung des Mitnehmers (14) mittels eines Impulsgebers (67, 68) steuerbar ist.
- 35 21. Vorrichtung nach Anspruch 20, dadurch gekennzeichnet, daß der Impulsgeber (67, 68) mikroprozessorgesteuert ist.
22. Vorrichtung nach Anspruch 20, dadurch gekennzeichnet, daß der Impulsgeber aus einer drehbaren Kodescheibe (67) und einem Sensor (68) besteht.
- 40 23. Vorrichtung nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß die Transportbahn (12) in eine der Nullstellung (13) gegenüberliegende Endstellung (17) bildenden Einstellplatz (3) schwenkbar ist, in der eine Öffnervorrichtung (16) für die Behälter (4) vorgesehen ist.
- 45 24. Vorrichtung nach den Ansprüchen 1 bis 5, dadurch gekennzeichnet, daß eine Leseeinrichtung (18) für die auf den Behältern (4) angebrachten Patientendaten vorgesehen ist, die in der Nullstellung (13) oder in der Endstellung (17) zwischen der Eingabestelle (1) und einer Bearbeitungsstation (15, 16) liegt.
- 50 25. Vorrichtung nach den Ansprüchen 1 und 2, dadurch gekennzeichnet, daß die Transportbahn (12) aus einem im wesentlichen allseitig geschlossenen vierkantrohrförmigen Gehäuse (11) mit einer im Bereich eines Bodenteiles (44) vorgesehenen Längsöffnung (81) besteht und daß der Mitnehmer (14) die Längsöffnung (81) durchgreift und mit einem von dem Schrittmotor (61) angetriebenen Zahnriemen (49) verbunden ist.
- 55 26. Vorrichtung nach den Ansprüchen 1, 2 und 25, dadurch gekennzeichnet, daß die die Transportelemente für den Mitnehmer (14) bildenden Bauteile, wie Schrittmotor (61), Laufrolle (48) und Zahnriemen (49), im Inneren des Gehäuses (11) angeordnet sind.

27. Vorrichtung nach den Ansprüchen 1, 2 und 25, dadurch gekennzeichnet, daß die Transportbahn (12) aus einem stabförmigen im Querschnitt U-förmigen Gehäuseteil (51) und einem stabförmigen im Querschnitt L-förmigen Bodenteil (44) besteht.
- 5 28. Vorrichtung nach einem der Ansprüche 1 bis 27, dadurch gekennzeichnet, daß die Führung der Halter (5) aus auf der Transportbahn (12) angeordneten T-förmig ausgebildeten Führungsbolzen (52) besteht.
29. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Einstellplätze (3) durch Stege (8) gegenüber abgeteilt sind.
- 10 30. Vorrichtung nach Anspruch 29, dadurch gekennzeichnet, daß die Stege (8) von der äußereren Begrenzung (9) der Einstellplätze (3) um einen vorbestimmten Betrag zurückversetzt beginnen und sich bis zu den Ausgängen (10) erstrecken.
- 15 31. Vorrichtung nach den Ansprüchen 29 und 30, dadurch gekennzeichnet, daß die Stege (8) eine Keilform aufweisen, deren breites Ende zur äußereren Begrenzung (9) zeigt.
32. Vorrichtung nach einem der Ansprüchen 29 bis 31, dadurch gekennzeichnet, daß die Stege (8) an ihrem äußeren Ende abgerundet sind.
- 20 33. Vorrichtung nach einem der Ansprüche 30 bis 32, dadurch gekennzeichnet, daß die Stege (8) um einen vorbestimmten Betrag kürzer sind als die Halter (5).
34. Vorrichtung nach den Ansprüchen 1 und 29, dadurch gekennzeichnet, daß die Eingabestelle (1) eine Wand (57) und Stege (8) aufweist, die im Bereich der Ausgänge (10) der Einstellplätze (3) Durchlaßöffnungen (58) bilden, die der Form und Größe der Halter (5) angepaßt sind.
- 25 35. Vorrichtung nach Anspruch 34, dadurch gekennzeichnet, daß die Stege (8) Führungsrippen (8') aufweisen, die seitlich in die Einstellplätze (3) ragen.
- 30 36. Vorrichtung nach einem der Ansprüche 1 bis 35, dadurch gekennzeichnet, daß die Länge der Transportbahn (12) mindestens die doppelte Länge eines Halters (5) aufweist.
37. Vorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß die Einstellplätze (3) auf einer Trägerplatte (2) angeordnet sind.
- 35 38. Vorrichtung nach Anspruch 37, dadurch gekennzeichnet, daß die Einstellplätze (3) um ein Maß in die Trägerplatte (2) vertieft angeordnet sind, das mindestens der doppelten Höhe des Fußes (83) des Halters (5) entspricht.

40 Revendications

1. Dispositif pour transporter dans un analyseur des conteneurs (4) remplis d'un liquide et disposés dans un râtelier (5), en particulier des éprouvettes remplies d'une sécrétion, depuis une station d'entrée (1) jusqu'à une station de traitement (15, 16) et inversement, caractérisé en ce que pour recevoir les râteliers (5) la station d'entrée (1) est constituée d'une pluralité de pistes pour râtelier (3) disposées côte à côte et dont les axes centraux (6) se coupent en un point (7) qui forme également le point d'appui (84) d'une voie de transport agencée avec faculté de pivotement (12) que l'on peut aligner avec l'une quelconque des pistes pour râtelier (3).
- 45 2. Dispositif selon la revendication 1, caractérisé en ce que la voie de transport (12) est constituée d'un boîtier (11) que l'on peut faire pivoter autour du point d'appui (84) et dont la partie d'extrémité libre s'étend jusqu'aux sorties agencées en arc de cercle (10) des pistes pour râtelier (3), et en ce que le logement (11) est déplacé par un moteur pas à pas (69) commandé par un microprocesseur.
- 50 3. Dispositif selon les revendications 1 et 2, caractérisé en ce qu'il est prévu une crémaillère en arc de cercle (35) qui s'engrène avec un pignon (36) agencé au niveau de la voie de transport (12) et relié au moteur pas à pas (69).

4. Dispositif selon les revendications 1 et 2, caractérisé en ce que pour aligner la voie de transport (12) chacune des pistes pour râtelier (3) est associée à une fente (31) qui peut être balayée par un capteur (32).
5. Dispositif selon les revendications 1 et 2, caractérisé en ce que l'on peut faire pivoter la voie de transport (12) jusqu'à une position zéro (13) à proximité immédiate des pistes pour râtelier (3).
6. Dispositif selon la revendication 5, caractérisé en ce que pour aligner la voie de transport (12) dans la position zéro (13) il est prévu plus d'une fente pouvant être balayée par capteur (31).
10. 7. Dispositif selon la revendication 5, caractérisé en ce que dans la position zéro (13) de la voie de transport (12) l'un des conteneurs (4) est positionné au-dessous d'un aspirateur (20) destiné au liquide et en même temps dans la zone d'un moyen de détecteur (22) destiné à balayer le conteneur.
15. 8. Dispositif selon la revendication 1, caractérisé en ce qu'il est prévu dans la zone de chaque piste pour râtelier (3) un moyen de retenue (19) destiné à un râtelier inséré (5), moyen qui peut être mis en prise lorsque la voie de transport (12) est alignée avec la piste pour râtelier respective (3).
20. 9. Dispositif selon la revendication 8, caractérisé en ce que le moyen de retenue (19) a la forme d'une bascule dont le premier bras de levier (24) sert d'élément de blocage (25) pour un râtelier (5) présent dans la piste pour râtelier (3) et dont le second bras (24') est conçu comme une lame (26) qui, dans une première position lorsque la piste pour râtelier (3) est vide, découvre un photocapteur (27) et, dans une seconde position lorsqu'un râtelier (5) est présent dans la piste pour râtelier (3), recouvre le capteur (27).
25. 10. Dispositif selon la revendication 9, caractérisé en ce que pour déplacer le moyen de retenue (19) à une troisième position dans laquelle la voie de transport (12) est dégagée et le capteur (27) est découvert, le second bras de levier (24') est muni d'un doigt (28) qui peut être actionné au moyen d'un plongeur (41) d'un électroaimant (40).
30. 11. Dispositif selon les revendications 9 et 10, caractérisé en ce que l'électroaimant (40) est commandé au moyen d'un microprocesseur (78) en réponse aux signaux du capteur (27).
35. 12. Dispositif selon les revendications 10 et 11, caractérisé en ce que la force d'attraction et la vitesse de relâchement de l'électroaimant (40) sont commandées.
13. Dispositif selon la revendication 12, caractérisé en ce que la force d'attraction est commandée au moyen de deux paliers d'intensité et la force de relâchement au moyen d'impulsions de courant inverse.
40. 14. Dispositif selon les revendications 1 et 2, caractérisé en ce qu'un support (33) est agencé au niveau de la voie de transport (12), support qui maintient l'électroaimant (40) destiné au moyen de retenue (19) et un capteur (32) associé aux fentes (31) de la station d'entrée (1).
45. 15. Dispositif selon les revendications 1 et 2, caractérisé en ce que dans la zone de la station d'entrée (1) il est prévu une plaque support de forme circulaire (34) sur laquelle des supports (39) reliés à la voie de transport (12) sont supportés de manière coulissante.
16. Dispositif selon la revendication 15, caractérisé en ce qu'il est monté deux supports (39) qui peuvent être réglés en hauteur.
50. 17. Dispositif selon les revendications 1 et 2, caractérisé en ce qu'il est prévu au niveau de la voie de transport (12) un élément de déplacement de râtelier (14) qui peut être accouplé au râtelier (5) et déplacé au moyen d'un moteur pas à pas commandé par microprocesseur (61).
18. Dispositif selon la revendication 17, caractérisé en ce que l'élément de déplacement de râtelier (14) est guidé de manière coulissante au niveau de la voie de transport (12) et comprend un crochet (56) s'étendant au-delà de la ligne centrale de la voie de transport.
55. 19. Dispositif selon la revendication 18, caractérisé en ce que lorsqu'un râtelier (5) est présent dans une piste pour râtelier (3), le crochet (56) de l'élément de déplacement de râtelier (14) s'engage dans une oreille (80) formée sur le râtelier (5) dès que l'on a fait pivoter la voie de transport (12).

20. Dispositif selon la revendication 17, caractérisé en ce que le déplacement de l'élément de déplacement de râtelier (14) est commandé au moyen d'un générateur d'impulsions (67, 68).
- 5 21. Dispositif selon la revendication 20, caractérisé en ce que le générateur d'impulsions (67, 68) est commandé par un microprocesseur.
22. Dispositif selon la revendication 20, caractérisé en ce que le générateur d'impulsions est constitué d'une roue codeuse rotative (67) et d'un capteur (68).
- 10 23. Dispositif selon les revendications 1 et 2, caractérisé en ce que l'on peut faire pivoter la voie de transport (12) jusqu'à une station d'entrée (1) qui définit une position d'extrémité (17) opposée à la position zéro (13) et dans laquelle il est prévu un moyen d'ouverture (16) pour les conteneurs (4).
- 15 24. Dispositif selon les revendications 1 à 5, caractérisé en ce qu'un dispositif de balayage des données se rapportant à un patient (18) lisant les données fournies sur les conteneurs (4) est disposé dans la position zéro (13) ou dans la position d'extrémité (17) entre la station d'entrée (1) et une station de traitement (15, 16).
- 20 25. Dispositif selon les revendications 1 et 2, caractérisé en ce que la voie de transport (12) est constituée d'un boîtier tubulaire de forme rectangulaire (11) qui est sensiblement clos de toutes parts et comporte une ouverture allongée (81) dans la zone d'une partie de fond (44), et en ce que l'élément de déplacement de râtelier (14) pénètre par l'ouverture allongée (81) et est relié à une courroie crantée (49) entraînée par le moteur pas à pas (61).
- 25 26. Dispositif selon les revendications 1, 2 et 25, caractérisé en ce que les composants formant les éléments de transport pour l'élément de déplacement de râtelier (14), c'est-à-dire le moteur pas à pas (61), le pignon (48) et la courroie crantée (49), sont disposés à l'intérieur du boîtier (11).
- 30 27. Dispositif selon les revendications 1, 2 et 25, caractérisé en ce que la voie de transport (12) est constituée d'une partie de boîtier allongée (51) de section transversale en forme de U et d'une partie de fond allongée (4) de section transversale en forme de L.
- 35 28. Dispositif selon l'une quelconque des revendications 1 à 27, caractérisé en ce que les râteliers (5) sont guidés par des montants de guidage en forme de T (52) disposés sur la voie de transport (12).
- 30 29. Dispositif selon la revendication 1, caractérisé en ce que les pistes pour râtelier (3) sont séparées l'une de l'autre par des cloisons (8).
- 30 30. Dispositif selon la revendication 29, caractérisé en ce que les cloisons (8) sont en retrait de la bordure extérieure (9) des pistes pour râtelier d'une valeur prédéterminée et s'étendent jusqu'aux sorties (10).
- 40 31. Dispositif selon les revendications 29 et 30, caractérisé en ce que les cloisons (28) sont en forme de coins, les parties d'extrémité large des coins faisant face à ladite bordure extérieure (9).
- 30 32. Dispositif selon l'une quelconque des revendications 29 à 31, caractérisé en ce que les cloisons (8) sont arrondies au niveau de leurs extrémités extérieures.
- 45 33. Dispositif selon l'une quelconque des revendications 30 à 32, caractérisé en ce que les cloisons (8) sont plus courtes que les râteliers (5) d'une valeur prédéterminée.
- 50 34. Dispositif selon les revendications 1 et 29, caractérisé en ce que la station d'entrée (1) comprend une paroi (57) et des cloisons (8) qui dans la zone des sorties (10) des pistes pour râtelier (3) définissent des passages (58) qui sont adaptés à la forme et la taille des râteliers (5).
- 30 35. Dispositif selon la revendication 34, caractérisé en ce que les cloisons (8) ont des ailerons de guidage (8') s'étendant latéralement dans les pistes pour râtelier (3).
- 55 36. Dispositif selon l'une quelconque des revendications 1 à 35, caractérisé en ce que la voie de transport (12) est au moins deux fois plus longue que le râtelier (5).
- 30 37. Dispositif selon la revendication 1, caractérisé en ce que les pistes pour râtelier (3) sont disposées sur

une plaque support (2).

38. Dispositif selon la revendication 37, caractérisé en ce que les pistes pour râtelier (3) sont noyées dans la plaque support (2) d'une valeur correspondant à deux fois au moins la hauteur de la base (83) du râtelier (5).

5
10

15

20

25

30

35

40

45

50

55

FIG. 1a

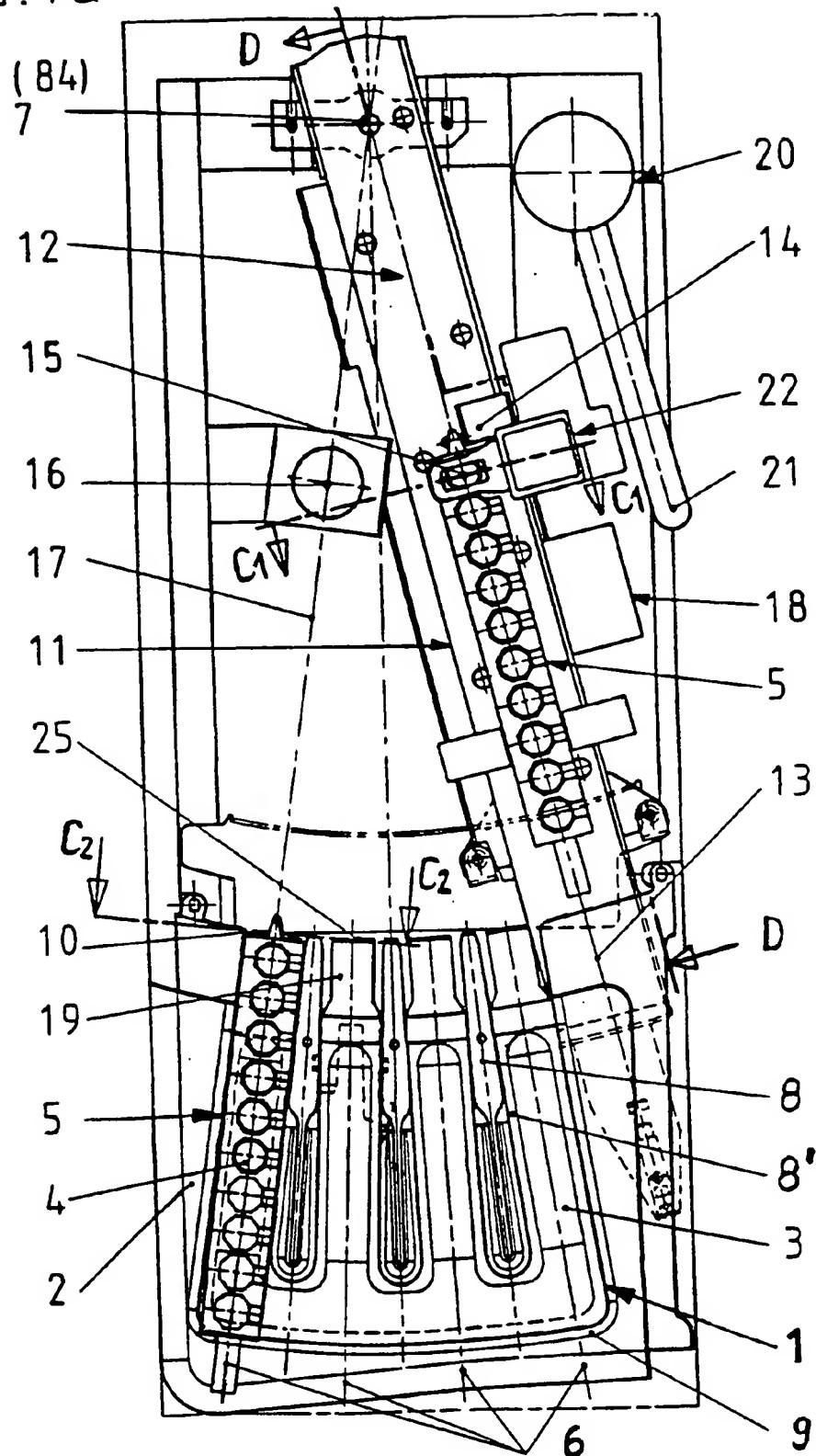


FIG. 1b

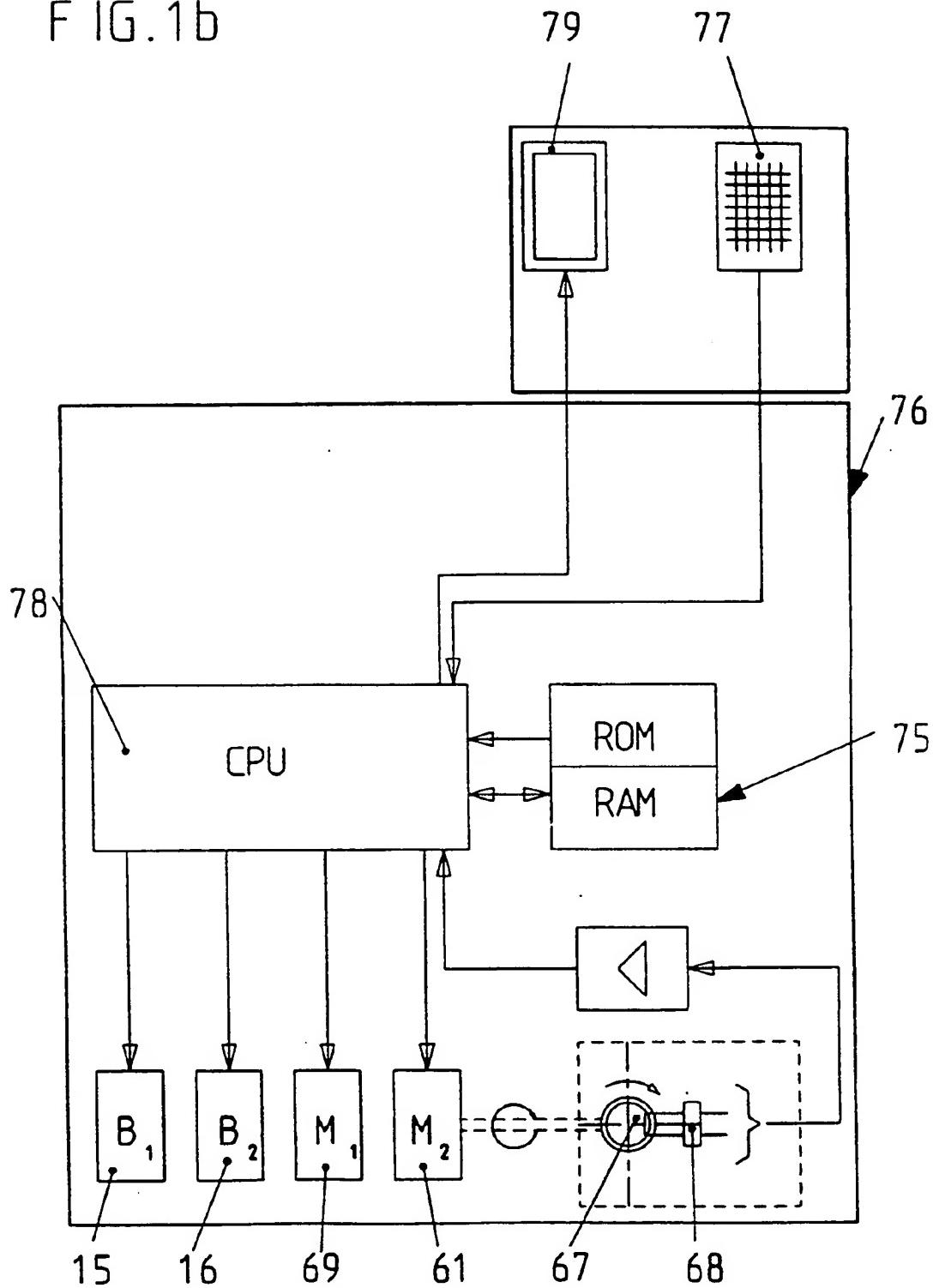


Fig.2

A-A

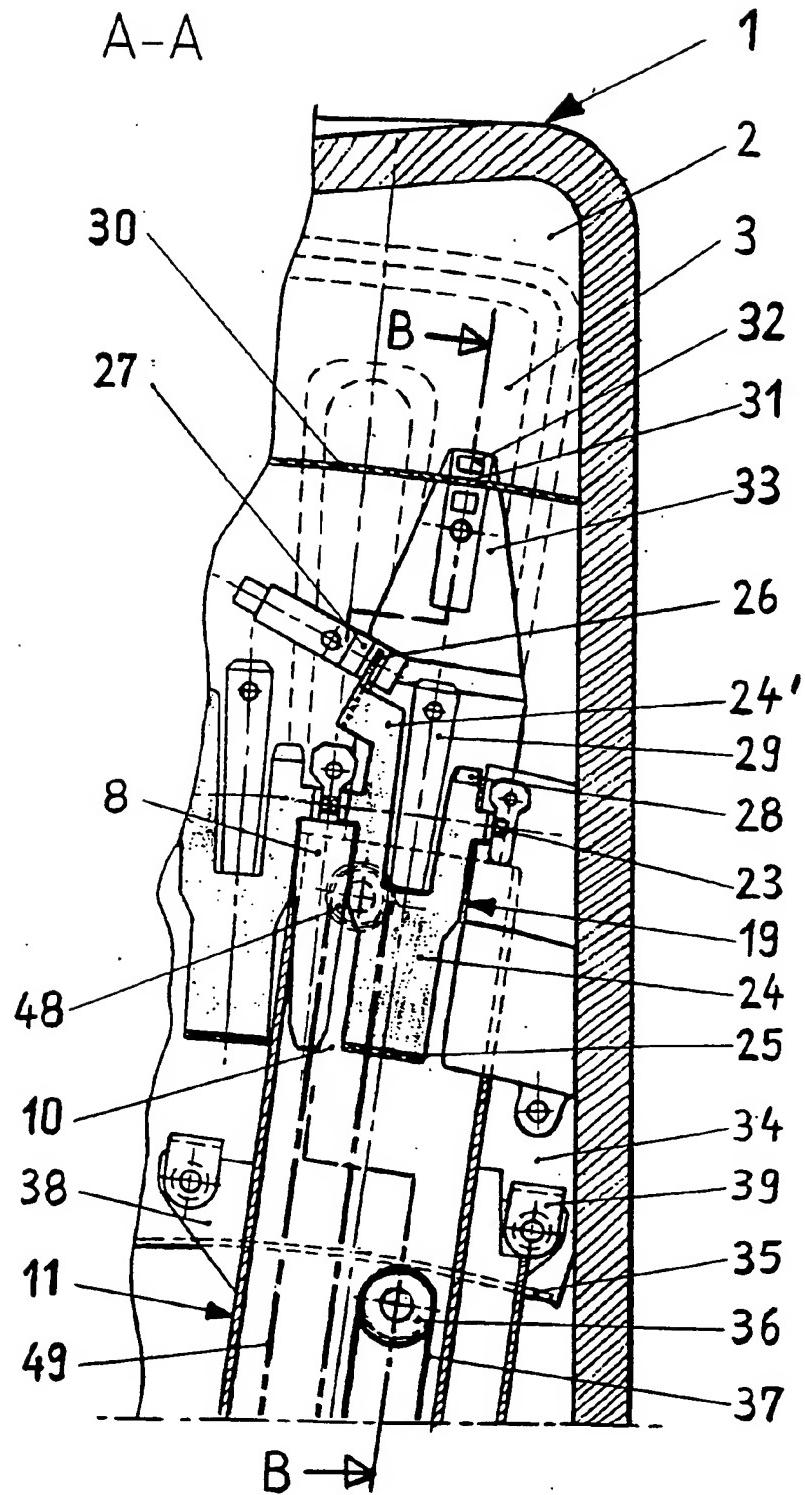


Fig. 3

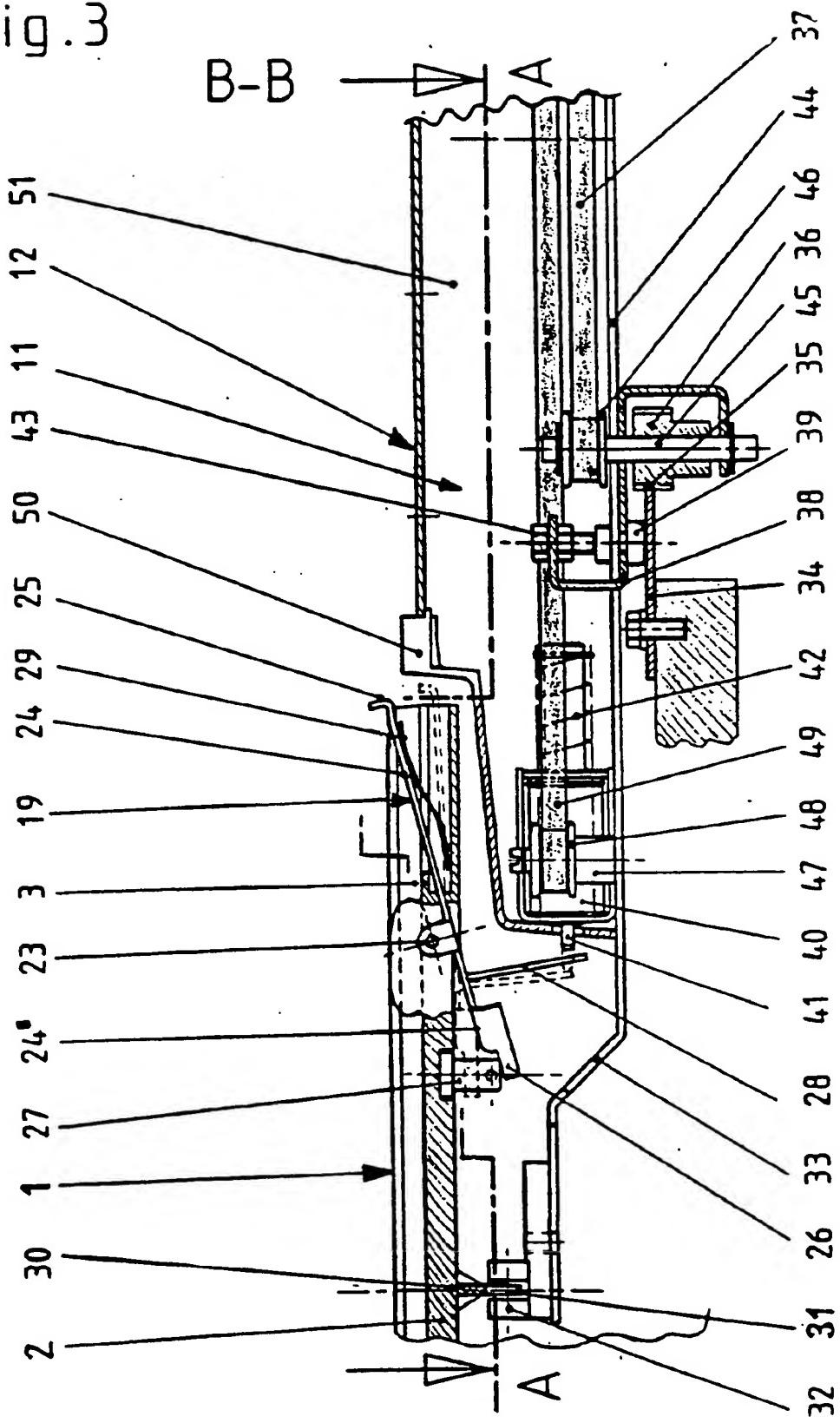


Fig.4

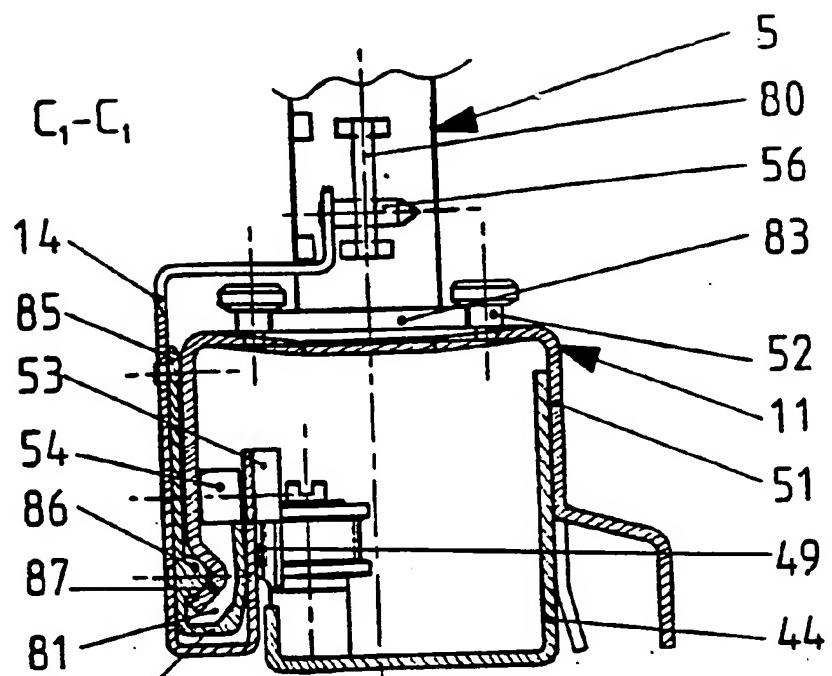


Fig.5

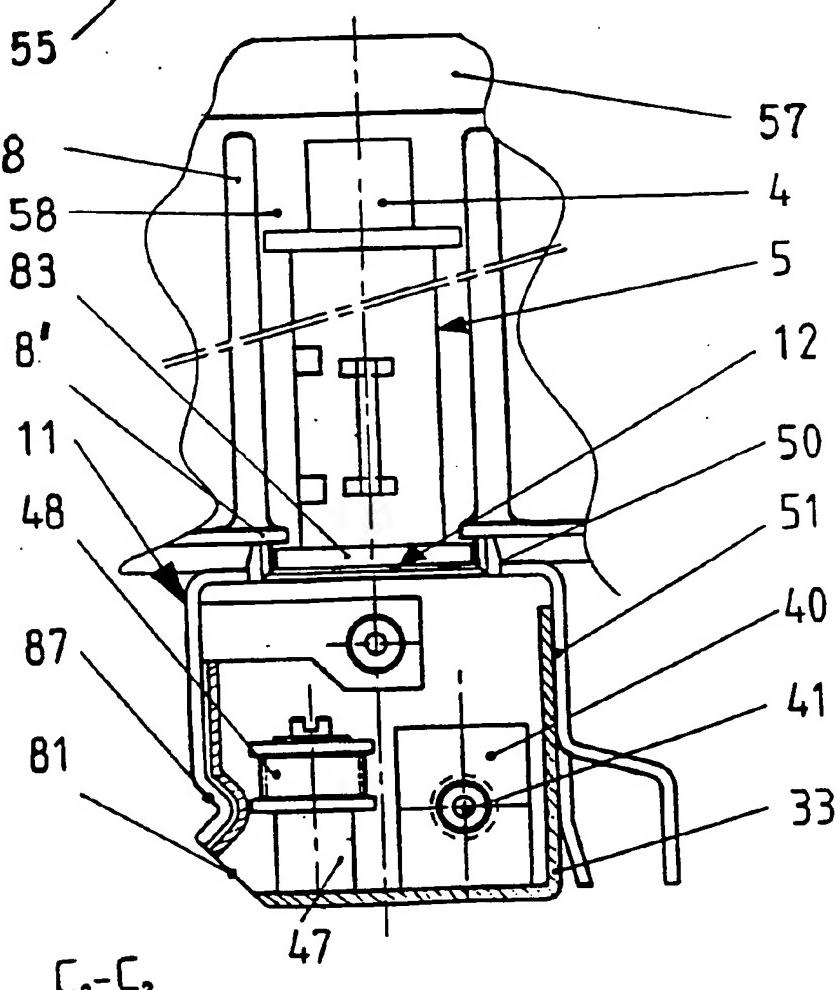


Fig. 6

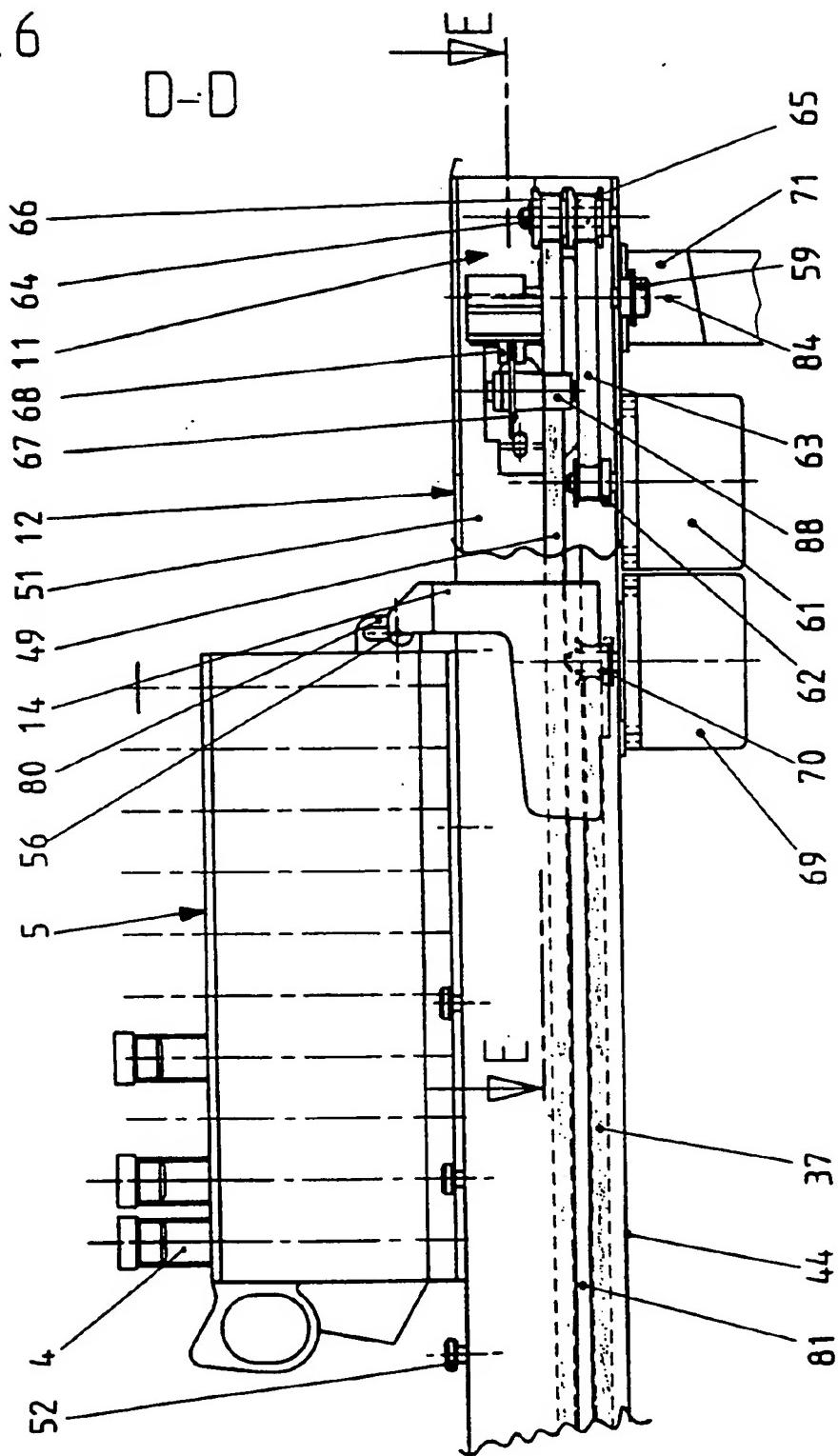


Fig. 7

E-E

